THE RULE OF LAW AND MEXICO'S ENERGY REFORM

The Environmental Challenges of the Energy Reform

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This study is dedicated to Stephen P. Zamora, our friend and colleague and one of the driving forces behind this project, who passed away before the completion of this study.

About the Study: The Rule of Law and Mexico's Energy Reform/Estado de Derecho y Reforma Energética en México

The 2013 changes to the constitutional framework and the summer 2014 enabling legislation in Mexico's energy industry represent a thorough break with the prevailing national narrative as well as the political and legal traditions of twentieth century Mexico. Mexico is about to embark on an unprecedented opening of its energy sector in the midst of important unknown factors, as well as a fiercely competitive and expanding international energy market. Mexico is one of the last developing countries to open its energy sector to foreign investment, and although there are important lessons that can be learned from other countries' experiences, this does not imply that the opening will be necessarily as successful as the government promises or that the implementation of the new laws will go smoothly. Almost certainly, after the enabling legislation goes into effect, important questions of law will emerge during the implementation, and unavoidably, refinements to the legislation will have to take place.

The book "Estado de Derecho y Reforma Energética en México," published in México by Tirant lo Blanch and written in Spanish, is the culmination of a major research effort to examine rule of law issues arising under the energy reform in Mexico by drawing on scholars and experts from American and Mexican institutions in order to bring attention to the different component parts of the new Mexican energy sector from a legal standpoint.

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Introduction

The energy reform in Mexico, promoted by the Enrique Peña Nieto administration, is possibly the most important structural change in the country over the past 70 years. The only comparable event was General Lázaro Cárdenas' 1938 oil expropriation announcement. The new legal regulations permit, among other things, the participation of private capital under more flexible contractual modalities in the hydrocarbons, electricity, and renewable energy subsectors. The objective of this reform, according to the federal executive branch, was to promote a sector that no longer covered the country's economic growth needs and no longer followed the logic dictated by international best practices. Therefore, the new energy sector regulations create opportunities in terms of additional economic growth as well as greater competitive supply, which, together with a more complex infrastructure, can lead to a drop in energy prices—which will help to make other industries in the country more competitive—and promote the diversification of Mexico's energy portfolio, covering its need to transition toward energy sources that cause less contamination and focus on environmental protection and utilizing natural resources.

Since this reform modifies the structure of a sector that is both complex and significant for the economic, political, and social dynamics of the country, it was to be expected that a number of critical voices would point out the details not addressed in an adequate manner to reach the expected goals and what the pertinent modifications might be to achieve them. Among the "small print" noted during discussion and implementation of the reform, the still lax capacity of the regulating bodies to guarantee competition in the new markets as well as the existing risk of an incomplete transition of Petróleos Mexicanos (PEMEX) and the Federal Electricity Commission (CFE) from quasi-State companies to productive State companies were mentioned. It was also pointed out that it was not advisable to convert the ministries of Energy and Treasury and Public Credit to factotums of the industry. Nonetheless, the risk, which until now, has not been the focus in different discussion forums or to the legislators who approved the energy reform, is related to the impacts of the energy reform on the country's natural resources and environment. As a matter of fact, with the current structure framed by the constitutional regulations and at the regulatory laws level, the energy reform may not favor the development of the hydrocarbons sector with a sustainable focus that combines the need to protect the environment with the generation of revenues through the use of the natural resources associated with the energy sector.

The package of regulatory laws for the new energy sector considers the establishment of the Security, Energy, and Environmental Agency (ASEA), which, among other tasks, will be in charge of protecting the personnel, environment, and infrastructure of the hydrocarbons sector. It also creates a regulatory framework setting the rules for surface use and occupation of the land where energy resources are located, as well as directions regarding the process to determine the economic impact of the potential damage the exploration, exploitation, and processing of such resources entails throughout the entire value chain. Nonetheless, and by virtue of the fact that there is no certainty regarding the effective counterweight the ASEA can exercise as the guarantor of environmental safety in the energy sector, this element could, on the one hand, suppose the breakdown of the

constitutional state, considering that the conduct of the participants in the new energy markets might not be guided by the law and that some regulators' efforts to interpret and apply the laws consistently may be rendered difficult; on the other hand, the laxness of the environmental regulations may represent an obstacle to achieving the expected benefits of the energy reform, since this suggests that a poor understanding persists regarding the relationship between natural resources and productive development in the country.

Taking the identification of the areas of the country that are subject to a change in soil use due to their abundance of energy resources that may be exploited by the energy reform as a starting point, this chapter points out the red lights of possible conflict in terms of access to and handling of natural resources and an environmental impact with considerable consequences on Mexico's natural capital—and on certain productive activities. Likewise, I will analyze the possible impact on natural resources and ecosystems, which may entail a conflict over location, an issue that is already subject to vulnerabilities.

This chapter is organized in the following manner: the next section indicates the opportunities the energy reform offers the country insofar as the exploitation of resources is concerned. Special attention will be paid to those energy resources that are most attractive for the new organization of the Mexican energy sector, meaning oil and gas located in deep waters of the Gulf of Mexico as well as shale oil and gas. Section three delimits the natural resources and ecosystems which match, in terms of location, the energy resources described in the preceding section and examines their environmental functions as well as, in some cases, their state of fragility. Section four explores the environmental challenges posed by the implementation of the energy reform; the focus of this section is that its economic and social benefits depend to a large degree on adequate regulation and application of the law that protects some key natural resources and at the same time promotes models for the use of the same resources for sustainable productive purposes. Finally, the last section presents conclusions and identifies possible lines of action to confront such challenges in a more expedient and effective manner.

Opportunity of the Energy Reform

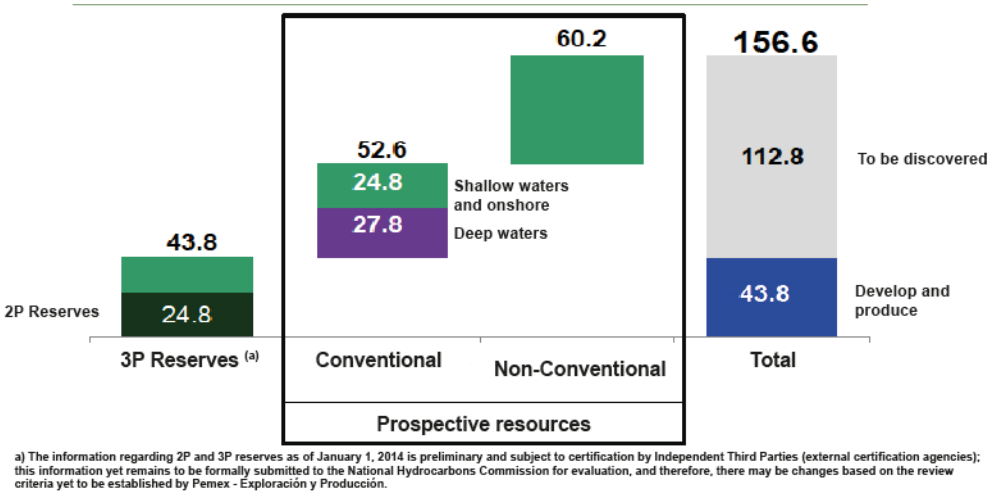
The energy reform symbolizes an opportunity for Mexico to utilize the energy resources that are necessary to maintain and promote its economic growth. Between 2000 and 2011, energy consumption by the Mexican population increased at an average annual rate average of 2.08 percent, but the production of primary energy during the same period decreased at a yearly rate of 0.3 percent.[1] This lack of balance posed a risk for the country's economic, since year after year, its incapacity to ensure the necessary energy resources required for the performance of productive activities was becoming more and more apparent.

This difficulty was associated with the depletion of reserves and the reduction in crude oil production, which at the same time stemmed from a drop in the drilling of exploratory wells and the growing number of fields in decline.[2] Additionally, the excess demand for natural gas as a result of limited transportation capacity and the insufficient distribution and storage network was becoming more pressing. Little geographical interconnection of

the electrical system, an aging transmission network, an increase in nontechnical losses, and an increasingly reduced margin of operational reserve collectively have created a burden to offering electrical rates that partially foster a competitive industrial sector in Mexico, among other things. Finally, this growing pressure to satisfy the country's energy demand also has its origin in an energy matrix that is highly dependent on hydrocarbons.

For these reasons, the energy reform makes it possible for Mexico to use prospective resources that, according to the Ministry of Energy (SENER), represent 72 percent of the country's total energy resources and which hardly could have been utilized under the prevailing financial structure of PEMEX prior to the reform. Among these prospective resources, 17.75 percent are located in deep waters in the Gulf of Mexico, and 38.44 percent are nonconventional sources, i.e., shale oil and gas.

Figure 1. Prospective resources of hydrocarbons of Mexico



Source: Main aspects of Round Zero, PEMEX.

The Natural Resources in Mexico and Their Environmental and Economic Value

Mexico is one of 17 mega-diverse countries in the world.[3] Mexico has more than 10,000 kilometers of shoreline and 12,500 square kilometers of coastal lagoons. Furthermore, Mexico has 10 percent of the world's total biodiversity, ranking fifth in terms of wealth of plants, first in wealth of reptiles, fourth in wealth of amphibians, and second in terms of wealth of mammals.[4] This natural capital not only bestows upon Mexico an aesthetic and cultural value, but also an economic one. Due to its geographic location, its variety of climates, its topography, and even its geological history, Mexico, along with Brazil, is the richest country in terms of ecosystems in Latin America.[5] These ecosystems provide a series of environmental services that fulfill different functions, including, for example: consumer goods, production inputs; climate regulation; regulation of water and air quality;

support of other ecosystemic services (i.e., soil formation); and promotion of the performance of productive activities such as agriculture, fishing, cattle raising, forestry, aquaculture, and tourism.

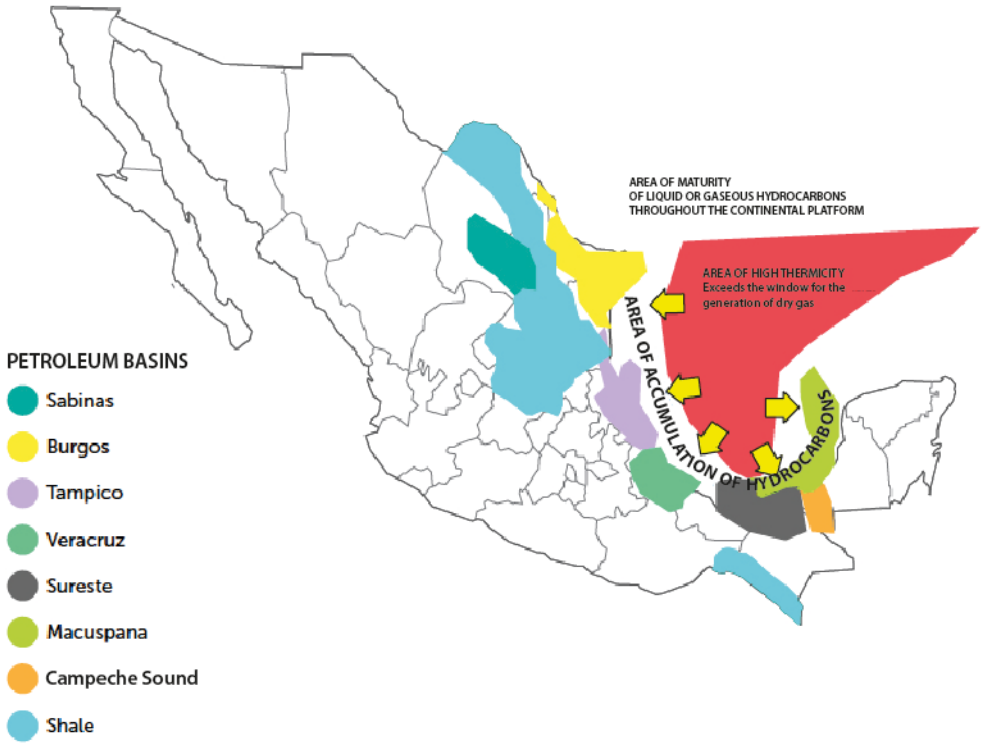
The fragility of the country's ecosystem is very high. Furthermore, a large proportion of the Mexican population is vulnerable to environmental disasters. Therefore, the very dynamics of the lax regulatory framework and low efficiency in terms of monitoring and compliance with environmental standards and regulations demonstrate such fragility, which is exacerbated by harsh social inequality. On the one hand, this requires Mexico to achieve solid economic growth that covers the demand and satisfies certain sectors of the population, yet on the other, it requires special attention for the most underprivileged sectors, which do not share in the benefits of this growth. Both conditions, however, exert pressure on the country's natural resources, considering that this makes it necessary to exploit them at accelerated rates without adequate regulation and monitoring; furthermore, this generates perverse scenarios of incentives for environmental degradation for individuals who do not have access to sustainable ways of production.

Therefore, the country faces a challenge of major proportion, one that is considered the holy grail of developing countries: how to achieve sustainable development. How can the country increase the production of goods and services without increasing its greenhouse gas emissions in a significant manner? To put the inexorable relationship between Mexico's environment and natural resources and its economic development into proper perspective, the economic function that is fulfilled by each of them must be understood. This must be the first step, even though not it is not focused exclusively on those areas of the country that have important energy resources to be developed within the scope of the new energy framework that is implemented through the reform.

Natural Resources in Areas of Potential Conflict

Due to the location of the prospective energy resources—oil in deep waters of the Gulf of Mexico and shale oil and gas deposits—it is estimated that there are 12 states of the Republic where a change in soil use that could result in potential environmental impact may occur. As shown in Figure 2, these federative entities are Chihuahua, Coahuila, Nuevo León, Tamaulipas, San Luis Potosí, Hidalgo, Puebla, Veracruz, Oaxaca, Tabasco, Chiapas, and Campeche.

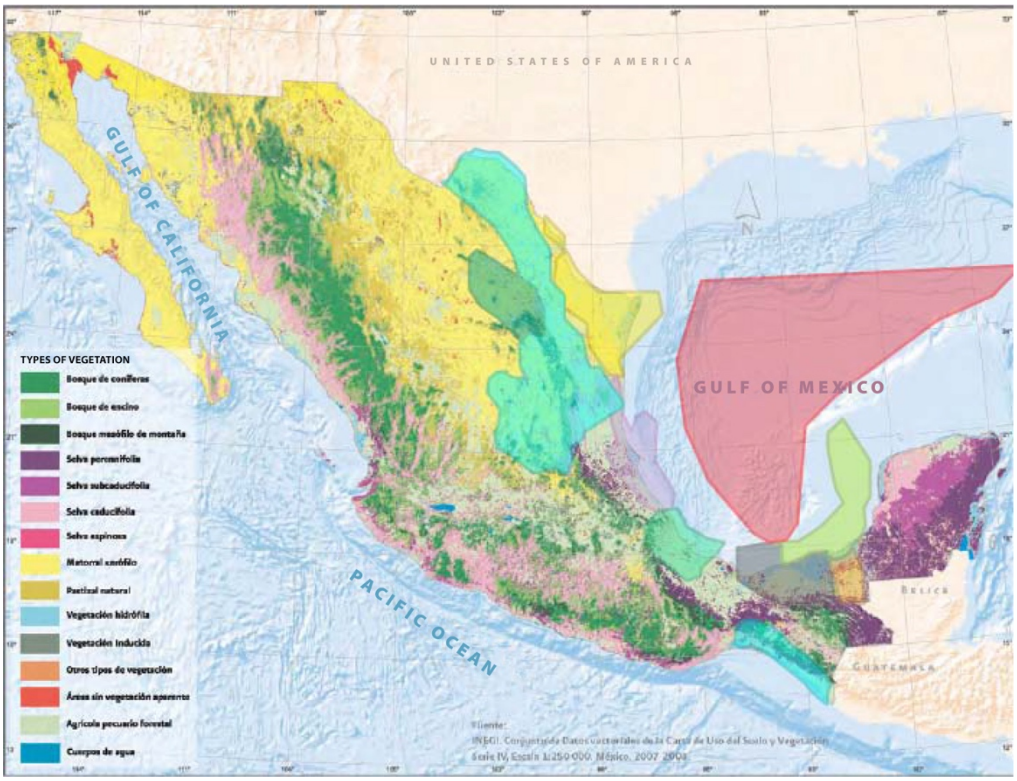
Figure 2. Hydrocarbon resources of Mexico



Source: Geographic Atlas of the Environment and Natural Resources, Ministry of Environmental Affairs and Natural Resources (SEMARNAT).

In terms of vegetation, in spite of representing only 1.4 percent of the world's land surface, Mexico features virtually all varieties of vegetation that are present on the planet.[6] This is why the forests in Mexico provide a broad range of environmental services, including retaining rain water; replenishing groundwater layers; reducing soil erosion as well as the risk of floods; the capture of CO_2; and the production of different products such as firewood, colorants, medicinal products, forestry products with a high commercial value (e.g., mahogany and cedar), coal, soap, rubber, fibers, chemical pulp and brown paper, among others; as well as spaces for rain-fed agriculture, pastures for cattle raising, and habitat for crops (e.g., papayas, avocados, beans, potatoes, and corn). As shown in Figure 3, a large part of the vegetation that provides such environmental services is located in areas of potential changes in soil use.

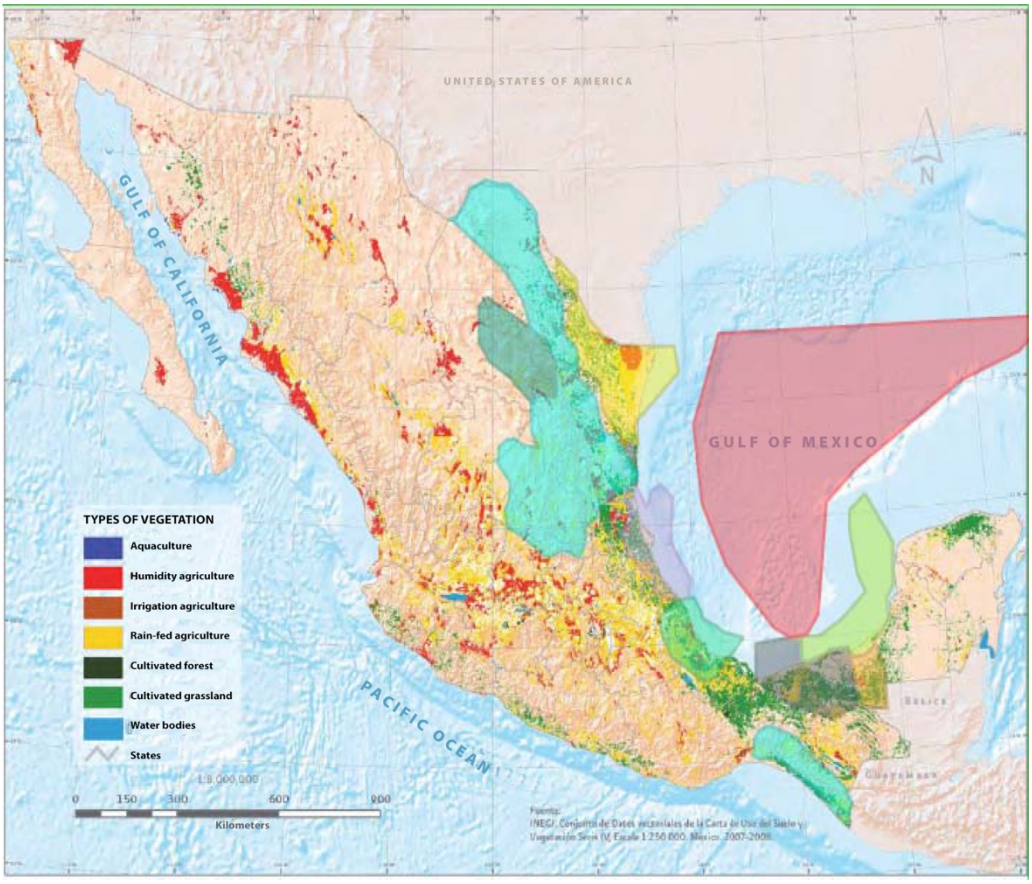
Figure 3. Types of vegetation in areas with prospective hydrocarbon resources in Mexico



Source: Geographic Atlas of the Environment and Natural Resources, SEMARNAT.

Another natural resource in a potentially vulnerable situation is agroecosystems. These are ecosystems that have been modified and manipulated by man for agricultural and cattle-raising purposes so that they may be utilized to obtain goods, services, and products for human consumption or commercial purposes. Figure 4 shows the type of agroecosystems located in the 12 states of the Republic that may be susceptible to a change in soil use as a result of the energy reform.

Figure 4. Type of agroecosystems and areas of prospective hydrocarbons resources in Mexico



Source: Geographic Atlas of the Environment and Natural Resources, SEMARNAT.

Even though the Gulf of Mexico only contains 11.1 percent of the mangroves in Mexico,[7] mangroves constitute a very important ecosystem. They perform important environmental functions such as flood control, shoreline stabilization, erosion control, and retention of sediments and toxic substances. They also serve as sites for the reproduction and nesting of fish and crustaceans. This ecosystem supports the fishing production of commercial species (e.g., catfish, mullet, bream, snapper, bass, shrimp, crab, lobster, and mollusks) and provides consumable materials for the construction of rural homes.

In areas that are susceptible to a change in soil use in connection with the energy reform, there are different types of surfaces that are rich in organic materials, which are useful for agricultural production (e.g., soy, wheat, and barley) and also facilitate humification processes and the production of small grains, fodder, and sugar cane. Precisely because the soils fulfill specific biological functions, their degradation and erosion have a direct impact on their economic productivity. These negative impacts include loss of fertility, acidification or reduction of pH, contamination, salinization, alkalinization, and eutrophication. As shown in Figure 5, in the federative entities that are susceptible to a

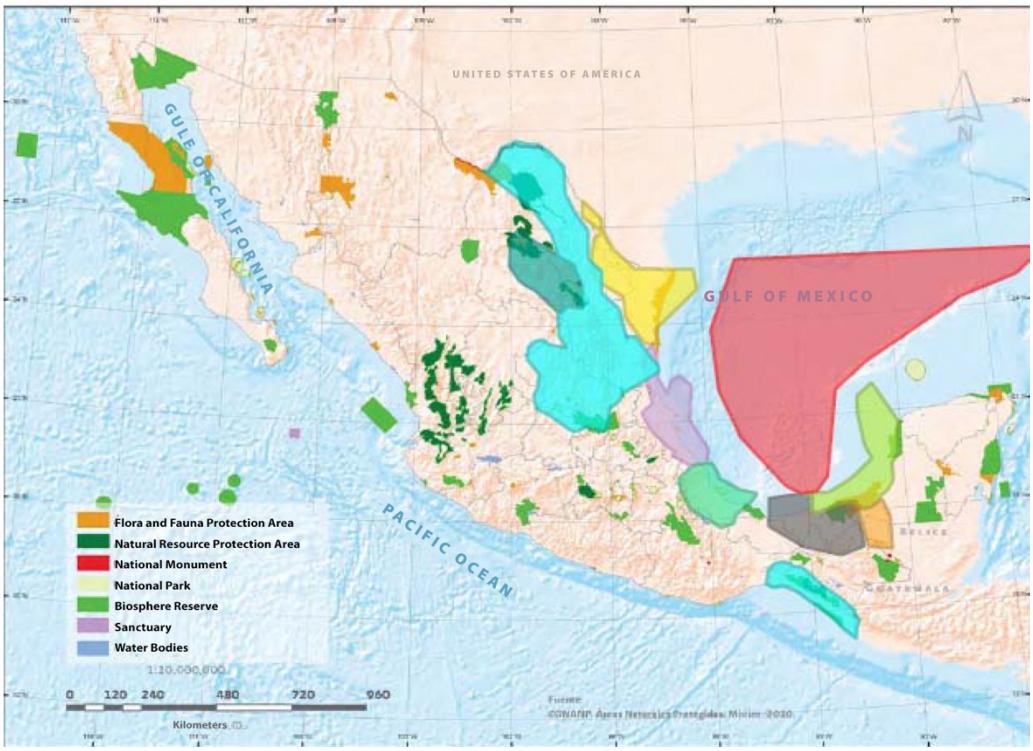
change in soil use as a result of the energy reform, except for some locations in Nuevo León and Tamaulipas, soils do not exhibit apparent deterioration or only represent light or moderate degradation.

Figure 5. Degradation of soils in areas of prospective hydrocarbons resources in Mexico

Source: Geographic Atlas of the Environment and Natural Resources, SEMARNAT.

In order to maintain the country's biodiversity, protected natural areas were created. The areas are onshore or offshore sections where the original environment has not been (and can not be) significantly modified through human activity and which therefore provide a great variety of environmental services. As shown in Figure 6, some protected natural resource areas match the areas that are susceptible to a change in soil use as a result of the energy reform.

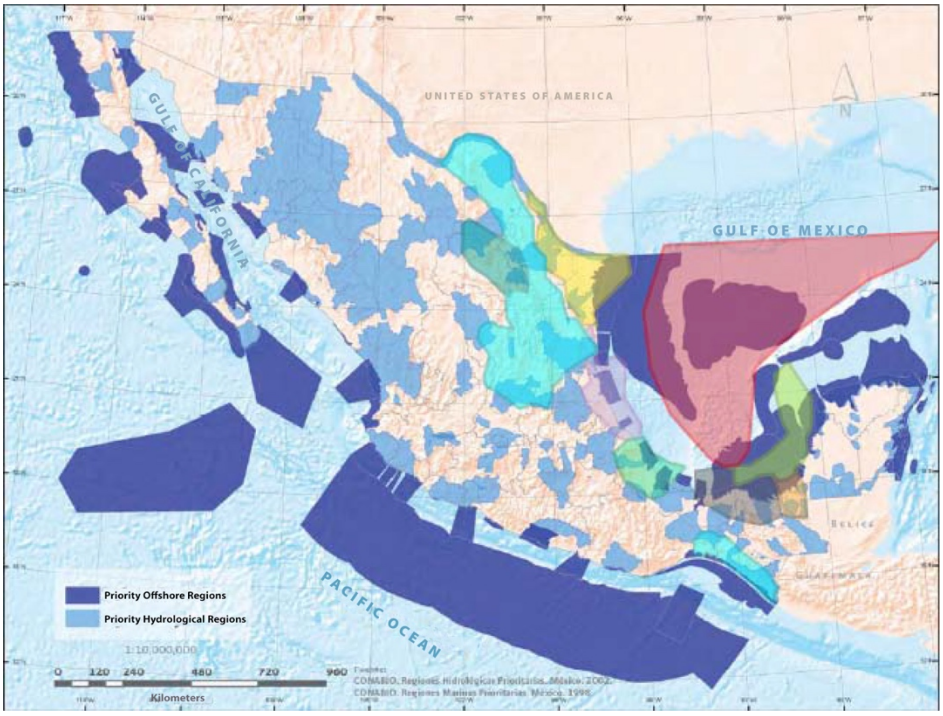
Figure 6. Protected Natural Areas in areas of prospective hydrocarbons resources in Mexico



Source: Geographic Atlas of the Environment and Natural Resources, SEMARNAT.

Priority Marine and Hydrological Regions (RMP) are territories of great importance for human activity in terms of marine and hydrological resources. They are defined based on environmental criteria (diversity, endemism, and wealth of species, among others), economic criteria (commercial importance of the species, economic value for other sectors, type of fishing organization, etc.), as well as based on criteria of threats (e.g., degree of pressure on key species, contamination, and level of impact on the environment). In terms of hydrological regions, the selection comprises those relevant water bodies that present problems such as excessive surface and underground exploitation, saline intrusion, desertification, and deterioration of the aquatic system, among others. Figure 7 shows the presence of RMPs within areas that are susceptible to changes in soil use as a result of the energy reform.

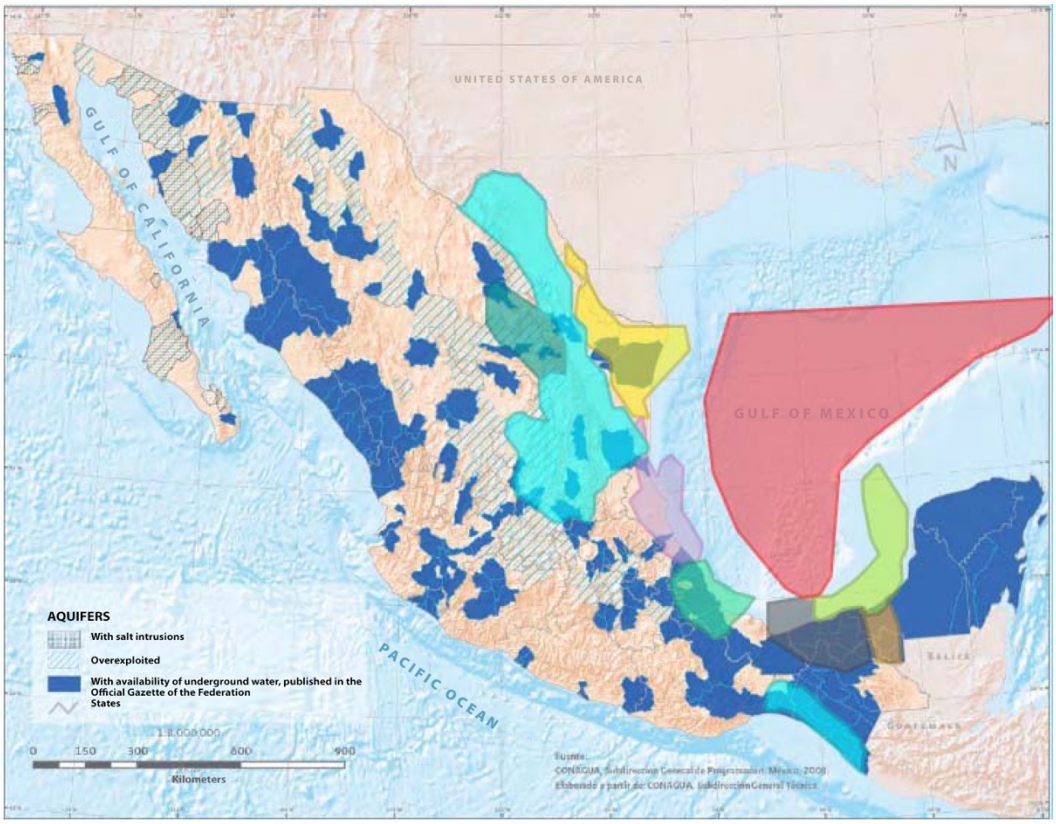
Figure 7. Priority Marine and Hydrological Regions in areas of prospective hydrocarbons resources in Mexico



Source: Geographic Atlas of the Environment and Natural Resources, SEMARNAT.

Aquifers are underground geologic formations that permit the circulation and storage of water coming from rainfall, rivers, lakes, and glaciers. In some regions of the country, the problem of excessive use and salinization of aquifers is very evident. Excessive use of aquifers causes growing difficulty in terms of extracting water from the aquifer, which directly impacts costs. Furthermore, this may also facilitate the travel of poor-quality water toward the aquifer, thereby decreasing its potential use for certain activities. Figure 8 shows the conditions of aquifers in areas that are susceptible to a change in soil use as a result of the energy reform.

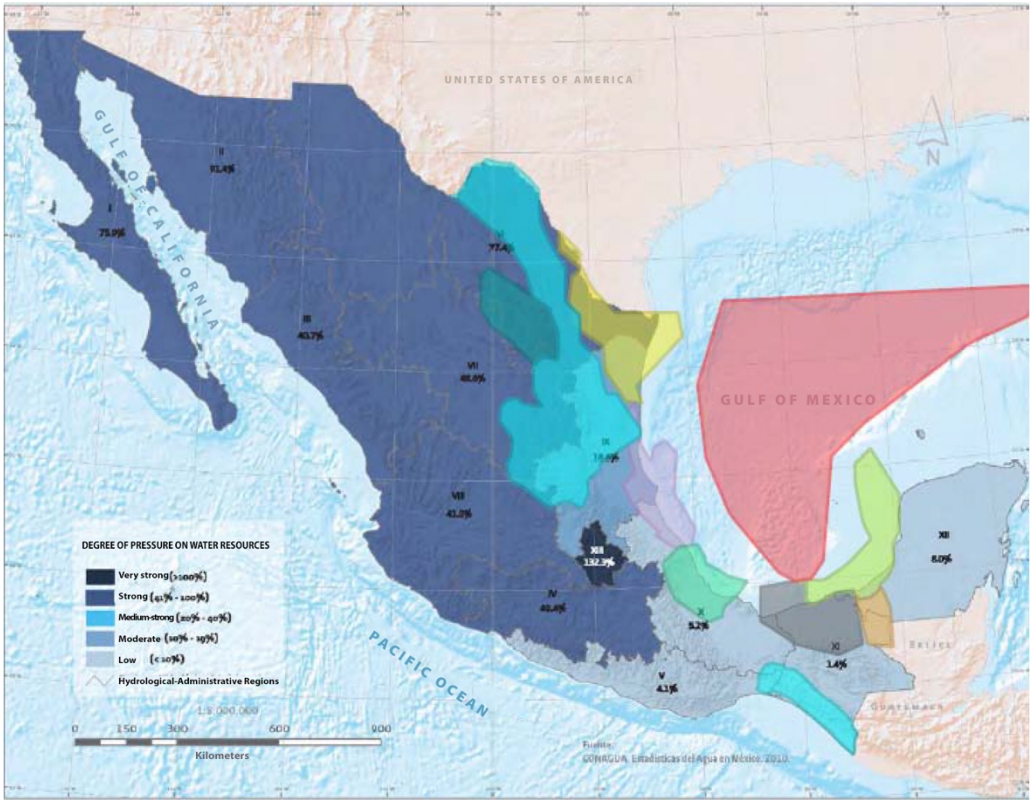
Figure 8. Condition of aquifers in areas with prospective hydrocarbons resources in Mexico



Source: Geographic Atlas of the Environment and Natural Resources, SEMARNAT.

Water availability is not uniform throughout the entire country. Nonetheless, despite the fact that there may be regions where water is readily available, there are also regions with high demand for this resource. In this respect, one of the most relevant measures for understanding the importance of water for human activity is the degree of pressure on water resources, a concept determined by the United Nations Commission on Sustainable Development. As a country, Mexico has a moderate degree of pressure, although part of the federative entities that are susceptible to a change in soil use as a result of the energy reform exhibits strong and medium-strong pressure, as illustrated in Figure 9.

Figure 9. Degree of pressure on water resources in areas of prospective hydrocarbons resources in Mexico



Source: Geographic Atlas of the Environment and Natural Resources, SEMARNAT.

Environmental Challenges Related to the Energy Reform

The reform represents a new framework for the energy sector in Mexico, the need for which was becoming increasingly urgent over time due to the inability of PEMEX and CFE to satisfy the country's energy demand within a context of economic growth expectations and new competitive conditions in the international energy scenario. However, the preceding section has indicated that a large part of the territory susceptible to a change in soil use is also an area with high natural capital and fragile ecosystem conditions that must be protected. It has therefore become imperative to balance the intense activities of the energy industry with those of other productive activities.

In view of the foregoing, the energy reform gave rise to the establishment of the Agency for Safety, Energy, and the Environment (ASEA), an organization dedicated to ensuring operational safety and environmental protection in connection with the activities of the hydrocarbons sector. The challenges faced by ASEA are not minor, considering that it must assume the powers of an entity that regulates and supervises the operating conditions of a larger sector that will gain a greater number of participants; likewise, it must regulate,

supervise, and appraise the environmental impact of operations in the hydrocarbons sector. In other countries such as the United States and the United Kingdom, this work is assigned to different entities. To combine them under ASEA may be an advantage because it eliminates transaction costs in terms of the resolution of disputes, although it may also be overrun in a scenario of public spending restraint, an issue the current administration is facing based on the low international price of oil.

Safety, Energy, and Environmental Agency

Within the package of laws regulating the energy reform, ASEA was created as a decentralized administrative body in the Ministry of Environmental Affairs and Natural Resources (SEMARNAT) and provided with technical and administrative autonomy. In terms of its environmental authorities, ASEA is in charge of protecting the environment through regulating and supervising the comprehensive control of residues and contaminating emissions. The law stipulates that ASEA will comply with the rules of other environmental laws[8] and that, within the scope of its functions, it will take sustainability criteria into consideration. Therefore, Article 5 of the law stipulates that ASEA will participate, together with SENER and SEMARNAT, in the development of the strategic evaluation of the sector. Furthermore, ASEA is assigned different functions to fulfill its environmental protection tasks. Among others, the following may be mentioned: participate in the prevention and handling of emergency situations in the activities of the sector; regulate, supervise, and issue sanctions in environmental protection matters; issue bidding guidelines and criteria for the adoption of best practices in terms of environmental protection; and regulate the "conditions of environmental protection of soils, flora, and wildlife to which the activities of exploration, extraction, transportation, storage, and distribution of hydrocarbons will be subject to avoid or minimize the environmental changes that are caused through these activities."

The great challenge ASEA faces is that it must be able to act as a counterweight in an energy sector with very powerful players—PEMEX and CFE, but also other large petroleum companies and electrical generators, where the operation of their projects has a privileged status with respect to other soil uses. Article 41 of the Hydrocarbons Act establishes that "In Protected Natural Areas, no assignments or contracts for the exploration and extraction of hydrocarbons will be granted," although this rule does not extend to projects related to the electrical sector or the exploitation of geothermal resources. It also does not apply to the performance of activities in the remainder of the hydrocarbons sector that also may cause environmental impact, such as transportation, storage, and distribution. Likewise, the performance of hydrocarbon exploration and extraction projects (as well as the remaining segments of the value chain) is also not prohibited in Ramsar[9] sites under any of the regulatory laws of the energy reform.

Furthermore, the Law of Coordinated Regulating Bodies in Energy Matters establishes that the role of ASEA, among other things, is "to analyze specific cases that may affect the performance of the public policies of the federal executive branch in energy matters and propose coordination mechanisms." Nonetheless, ASEA can only participate in the Coordinating Council of the Energy Sector with the express invitation by the council's

president, meaning the minister of energy. Therefore, there is an evident asymmetry in the weight that environmental considerations may have within the scope of the council's decision-making process with respect to energy policy considerations, but also a potential conflict of interest in terms of what precisely is the factotum of the energy sector, which may or may not invite the party that may potentially act as a counterweight. Furthermore, SEMARNAT itself has no vote within the council. Therefore, the great challenge ASEA faces is to note and express possible environmental risks associated with energy sector projects to a council in which only SENER, the National Hydrocarbons Commission, the Energy Regulating Commission, the National Natural Gas Control Center, and the National Energy Control Center have a vote. The following subsections will explore other challenges ASEA must face to guarantee the development of a suitable energy sector in Mexico.

Use of Natural Resources

Water is one of the resources that will be an essential consumable for the development of a nonconventional resources and geothermal power industry. Therefore, the Geothermal Energy Act contains a section defining water use in the geothermal industry. The absence (before the reform) of a specific legal treatment of water for geothermal use—which has completely different physical qualities and chemical content than water used for human consumption—caused disputes with the National Water Commission regarding the exploitation and utilization of geothermal resources.

In the same respect, the General Water Act (LGA) was proposed in March 2015. Beyond regulating Article 4 of the Constitution, which defines the human right of access to water, the draft of the LGA establishes guidelines to facilitate the performance of some economic activities and, in particular, hydraulic fracking, a technique used to fracture shale rocks and thereby release the oil and gas contained therein. As of the writing of this text, the LGA was scheduled to be considered in the Chamber of Deputies; therefore, it is difficult to speculate whether these regulations will grant the certainty required to resolve conflicts in terms of disputes regarding the use of water resources among productive activities.

Regardless of the fact that such legislation is pending, there is no strategic plan to guarantee access to water resources. The regions rich in nonconventional resources in Mexico are Coahuila, Nuevo León, Tamaulipas, San Luis Potosí, Veracruz, Tabasco, Chiapas and the southeastern region of Oaxaca. Some of these federative entities have strong or medium-strong pressure on water, meaning that, from a sustainability perspective, use of water resources in such states for agricultural, public, industrial, or other purposes is approaching the existing limit of availability.[11] It is not clear how it will be possible to develop the shale industry in Mexico—as the United States has done—in a region without the proper infrastructure to guarantee the supply and protection of scarce water resources.

Additionally, there is an ongoing debate regarding the environmental impact caused by hydraulic fracking. The U.S. Environmental Protection Agency itself has not yet completed its impact study on fracking. The study is analyzing the entire value chain for the process of exploitation of shale deposits in the United States, meaning the acquisition of water resources, the chemical composition of the fracking fluid, injection into the well, the

recovery of injected water, and, finally, the disposal and treatment of used water. Considering the importance of the natural resources and ecosystems located in places with shale resources, a study of the same kind must be conducted in Mexico before the industry starts operations. Furthermore, conducting such a study is a part of ASEA's authority as a guarantor of the resources and environment in the hydrocarbons sector.

The main risk in terms of the use of water resources within the context of the energy reform is that, in the absence of a strategic plan guaranteeing access to resources and studies on the potential environmental impact of hydraulic fracking, Chapter VII of Title Six in the LGA will establish a water transfer process. Specifically, Article 116 defines this transference as "the exploitation, use, or utilization of national waters transferred from a basin to be used in a different basin with which there is no natural connection, carried out by the Federation, assignees, or concessionaires, through hydraulic infrastructure work, for concession, exploitation, use, or utilization in a place other than the basin of extraction." Another aspect to be considered during future discussions of the LGA is whether ASEA will have a role in the LGA as a guarantor of the safety and environment of the hydrocarbons sector. This is due to the fact that the Bill of the Decree issuing the LGA, which was presented by the Chamber of Deputies' joint Commissions on Drinking and Sanitary Water and Hydraulic Resources, does not contemplate the participation of ASEA in matters of identifying and protecting water resources, not even in the case of disasters or emergencies, both pursuant to Titles Eight and Nine of the LGA. What entity will therefore be responsible for handling and coordinating a possible emergency in the hydrocarbons sector that impacts water bodies? Will it be ASEA, the Ministry of the Interior, the Ministry of the Marine, or SEMARNAT?

Environmental Impact and Compensation for Environmental Damages

One of the greatest challenges posed by the energy reform is the performance of the actual energy resources exploration and exploitation activities, as well as their transportation, storage, distribution, and trading. The Law of the National Agency of Industrial Safety and Environmental Protection of the Hydrocarbon Sector authorizes ASEA to establish regulations regarding the conditions and actions that will be taken in terms of compensation for any environmental damage that occurs. Article 101 of the Hydrocarbons Act establishes that compensation for any impact on land and goods that is deemed necessary for hydrocarbons exploitation and extraction projects will be negotiated and agreed upon between the landowners or holders and the project assignees or contractors. Likewise, Article 3 of the Internal Regulation of the National Agency of Industrial Safety and Environmental Protection in the Hydrocarbon Sector establishes that the executive director of ASEA will have the authority to "coordinate the studies of economic assessment of environmental externalities and risks associated with the facilities, activities, and operations of the sector based on a methodology which takes best international practices into account."

Despite the fact that the ASEA internal regulation act is a step ahead for the exercise of its powers, it is complicated to assume, on the one hand, that ASEA will have the effective capacity to monitor each and every one of the exploration and exploitation projects in the

Gulf of Mexico as well as engage in the same level of supervision over the remainder of the hydrocarbons sector value chain; on the other hand—and it remains to be seen whether the guidelines for the regulation exercised by ASEA are more prescriptive or focused on results—the instruments for the management of claims and indemnifications will have to be aligned with the international standards and regulations in force and effect, meaning the Civil Liability Convention (CLC) and the International Convention of the Constitution of the International Oil Pollution Indemnification Fund (IOPC).

The accident of the Deepwater Horizon platform on April 22, 2010, became a watershed in terms of industrial safety and environmental protection regulation in the deep-water industry and, in general, in the U.S. petroleum industry. The most noteworthy experience in Mexico was the explosion of the Ixtoc I platform in 1979, an episode that did not lead to major regulatory changes in the country. Precisely for such reason—and unlike what happens in the United States, where response protocols for accidents are clearly coordinated—there is uncertainty in Mexico with respect to the response coordination procedures for potential accidents between ASEA and other entities such as the Ministry of the Navy, the Ministry of the Interior, and the Ministry of Health.

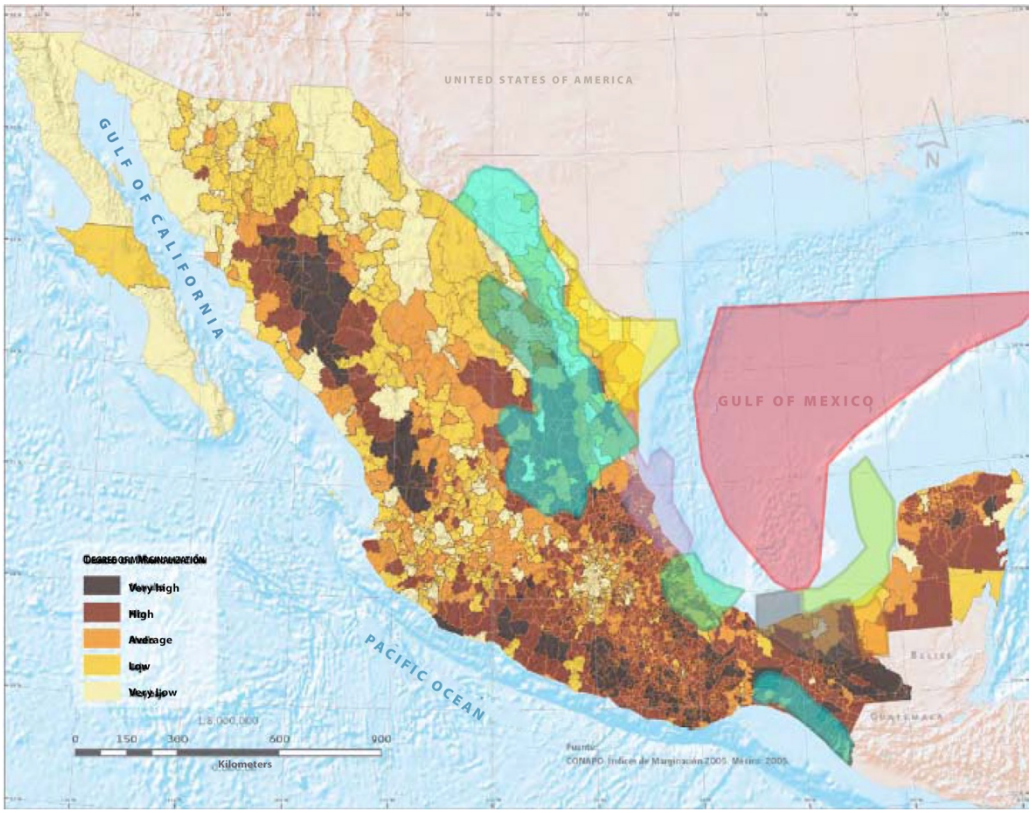
Even when ASEA can exercise the powers vested in it by the law, what actual capacity does it have to coordinate other public federal entities and society in response to a possible accident? How could it guarantee that the compensation for the environmental impact can restore the lost natural capital? What environmental valuation techniques will it use to establish the compensation that would be required for irreversible ecosystem damage and the resulting implications for other productive activities?

If the ASEA regulation establishes eligibility for claims of indemnity based on the spirit of the CLC and IOPC, compensation could be granted for material damages, costs of cleanup operations on both land and sea, economic fishing loss suffered by individuals engaged in mariculture, economic losses in the tourism sector, and costs for environmental restoration. However, Article 4 of the IOPC Convention establishes that “the expenses or sacrifices reasonably incurred by the owner in a voluntary manner to avoid or reduce contamination are considered damage through contamination.”

It is precisely here where ASEA faces a great challenge, as well as an opportunity, to define what “reasonable” means. As a matter of fact, based on the close relationship between natural resources and productive systems, the structure of compensations for environmental damage that ASEA will design should consider not only the amount of the damage that may be caused by energy sector activities, but rather also the social externalities such damage entails. In this respect, it is important to highlight the great dependency of several communities in the 12 states who may be subject to possible impact due to a change in soil use on their natural capital. A large number of these communities have a considerable degree of marginalization. Marginalization for the purposes of this writing refers to the exclusion of these communities from participating in and reaping the benefits of economic development as a result of a weak structure that exposes them to deprival, risks, and social vulnerability. This is not a minor problem. According to data

from the National Population Council, on average, six out of every 10 individuals living in the 12 federative entities mentioned above are subject to high marginalization, whereas two out of every 10 individuals experience very high marginalization. This means that approximately 35 million people living in the federative entities susceptible to changes in soil use as a result of the energy reform are subject to high and very high marginalization.[11]

Figure 10. Degree of marginalization of the population in areas of prospective hydrocarbons resources in Mexico



Source: Geographic Atlas of the Environment and Natural Resources, SEMARNAT.

The effective counterweight ASEA can provide as a guarantor of the environmental safety of the most vulnerable communities therefore takes on utmost importance. Articles 100 through 117 of Chapter IV of the Hydrocarbons Act establish guidelines for the use and surface occupation of land, goods, or rights that are necessary for hydrocarbons exploration and extraction activities. To ensure that the degree of vulnerability experienced by several communities does not worsen, it will be essential that ASEA identify their degree of dependency with respect to the natural resources affected by the activities of the hydrocarbons sector value chain.

Conclusions and Public Policy Recommendations

This section concludes with public policy recommendations that strive to underscore the relevance of the environment for the productive development of the country. This does not in any manner mean that the new energy industry regulations must be subordinated to ecological considerations that seek to protect the environment based on its intrinsic value. This means that, for the new energy sector in Mexico to spearhead the economic development of the country, it must follow the best international practices in terms of sustainability. Likewise, ASEA must establish regulatory criteria for operating safety[12] and environmental protection[13] in the hydrocarbons sector based on a perspective that the handling of natural resources and productivity of the country remain closely related.

Assuming from the get-go that the productive activities of the hydrocarbons sector will be prioritized over any other soil use, such projects require strategic planning that guarantees performance that is sustainable over the entire service life of the project and minimizes the impact such operations will have on other productive activities—among them fishing, agriculture, tourism, and cattle raising. Such strategic planning on the one hand must contemplate the existing risk of environmental damage and its potential externalities—including social ones—not only to establish compensation for landowners whose soil is sought to be modified, but also to determine the actual opportunity cost represented by the activities of the hydrocarbons sector. The regulatory exercise of these strategic plans demands that both SEMARNAT as well as ASEA become permanent members of the Coordinating Council of the Energy Sector with voting rights, precisely to acknowledge the importance of Mexico's natural resources—including hydrocarbons and renewable energy sources—for the development of a competitive energy sector over the long term.

On the other hand, in conjunction with the National Water Commission and federal, state, and local authorities, a properly defined strategy for access to water resources must be designed for those areas where the degree of pressure is more than moderate an industry with high intensity in terms of water use, such as the shale industry, may be established. This strategy must serve to create an infrastructure network that assists vulnerable areas in the case of extreme, climate change-related meteorological phenomena to relieve excessive resources and channel them—with adequate treatment—toward areas subject to the greatest degree of pressure.

Additionally, and prior to the start of any shale industry operations, it is necessary to conduct studies evaluating the impact of such industry in the basins of Mexico. It is not sufficient to familiarize oneself with the results the U.S. Environmental Protection Agency will report as soon as it completes its study. Furthermore, a strategic plan is required regarding the treatment of water resources along the entire value chain of shale oil and gas production.

Finally, and despite the fact that some institutions such as the National Institute of Ecology and Climate Change are currently working on this, more accurate information is required regarding the environmental impact changes in ecosystems cause on the different productive systems of the country, based on general balance models. This is the only way

that we will be able to estimate the economic impact a possible change in natural resources through an energy project—or through another type of phenomena—will have on other economic sectors.

Mexico has finally reached the political consensus to rearrange its energy sector to achieve competitiveness in accordance with the requirements of international markets. Converting such sector into the cornerstone of economic development in the country also requires sizing up the role played by its natural resources and its ecosystems. Otherwise, the risk exists that the benefits of the energy reform will become diluted over time.

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Endnotes

[1] Ministry of Energy, *National Energy Strategy 2013-2027* (Mexico City, Federal District: SEMARNAT, 2013), p. 3.

[2] Development Research Center, Civil Association. *3 Dilemmas: A diagnosis for the Energy Future of Mexico* (Mexico City, Federal District: CIDAC, 2013).

[3] On February 18, 2002, the Cancun Declaration of like-minded, mega-diverse countries was issued, establishing the Group of Megadiverse Countries as a mechanism for consultation and cooperation to promote their interests and priorities regarding the preservation and sustainable use of biological diversity.

[4] Brian Groombridge, ed., *Biodiversity Data Sourcebook. World Conservation Monitoring Centre* (Cambridge: World Conservation Press, 1994).

[5] Eric Dinerstein, David M. Olson, Douglas J. Graham, Avis L. Webster, Steven A. Primm, Marnie P. Bookbinder, and George Ledec, *A Conservation Assessment of the Terrestrial Ecoregions of Latin America and the Caribbean* (Washington, D.C.: World Bank, 1995).

[6] Ministry of Environmental Affairs and Natural Resources (SEMARNAT), 2010: p. 26.

[7] Comisión Nacional Para el Conocimiento y Uso de la Biodiversidad, *Mangroves of Mexico. Extension and distribution* (Mexico City, Federal District: CONABIO, 2008).

[8] The General Ecological Balance and Environmental Protection Act, the General Law for the Prevention and Comprehensive Management of Residues, the General Law of Sustainable Forestry Development, the General Wildlife Act, the Law of Biosecurity of Genetically Modified Organisms, and other applicable regulations.

[9] According to SEMARNAT, the Convention on Wetlands of International Importance is a convention Mexico joined in 1986 to preserve and use wetlands in a rational manner, in particular, though not exclusively, as a habit for aquatic birds. Mexico has 142 "Ramsar sites," including wetlands, mangroves, offshore meadows, and coral reefs, among others.

[10] According to the United Nations Commission on Sustainable Development, strong and medium-strong pressure means that between 41 percent and 100 percent and between 20 percent and 40 percent of available water are extracted, respectively.

[12] The states of Chiapas, Oaxaca, Puebla, San Luis Potosí, Veracruz, and Campeche, whose proportion of its population subject to high and very high marginalization totals 94.16 percent, 91.26 percent, 89.98 percent, 87.48 percent, and 83.96 percent, respectively, deserve special attention. The population subject to high and very high marginalization in these states totals 23 million.

[12] Article 3 of the law creating ASEA establishes that such criteria will take care "of the processes contained in the technical, administrative, and operational standards and rules in respect of technology applied as well as the analysis, evaluation, prevention, mitigation, and control of the associated process risks, from the phase of design, construction, startup and commissioning, routine operation, scheduled and emergency shutdowns, and preventive and corrective maintenance. It also includes operating procedures and safe practices, training and performance, investigation and analysis of incidents and accidents, emergency response plans, audits, quality assurance, pre-startup, mechanical integrity, and change management, among others."

[13] Article 2 of the ASEA Act establishes that, in the exercise of its functions, the agency "will take criteria of sustainability and low-emissions development into consideration as well as will comply with the rules in the General Ecological Balance and Environmental Protection Act, the General Law for the Prevention and Comprehensive Management of Residues, the General Law of Sustainable Forestry Development, the General Wildlife Act, the Law of Biosecurity of Genetically Modified Organisms and further applicable regulations."